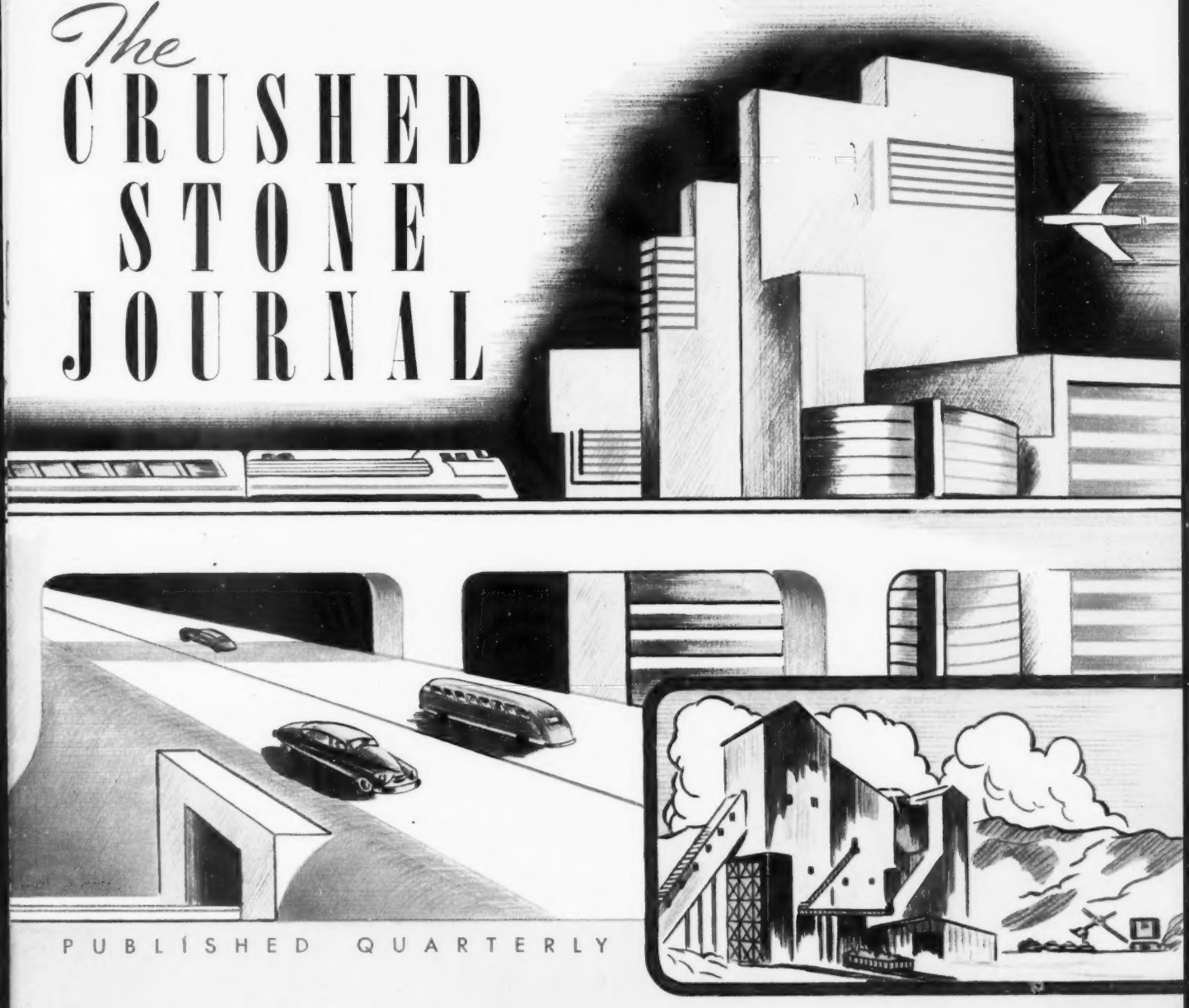
The CRUSHED STONE JOURNAL



PUBLISHED QUARTERLY

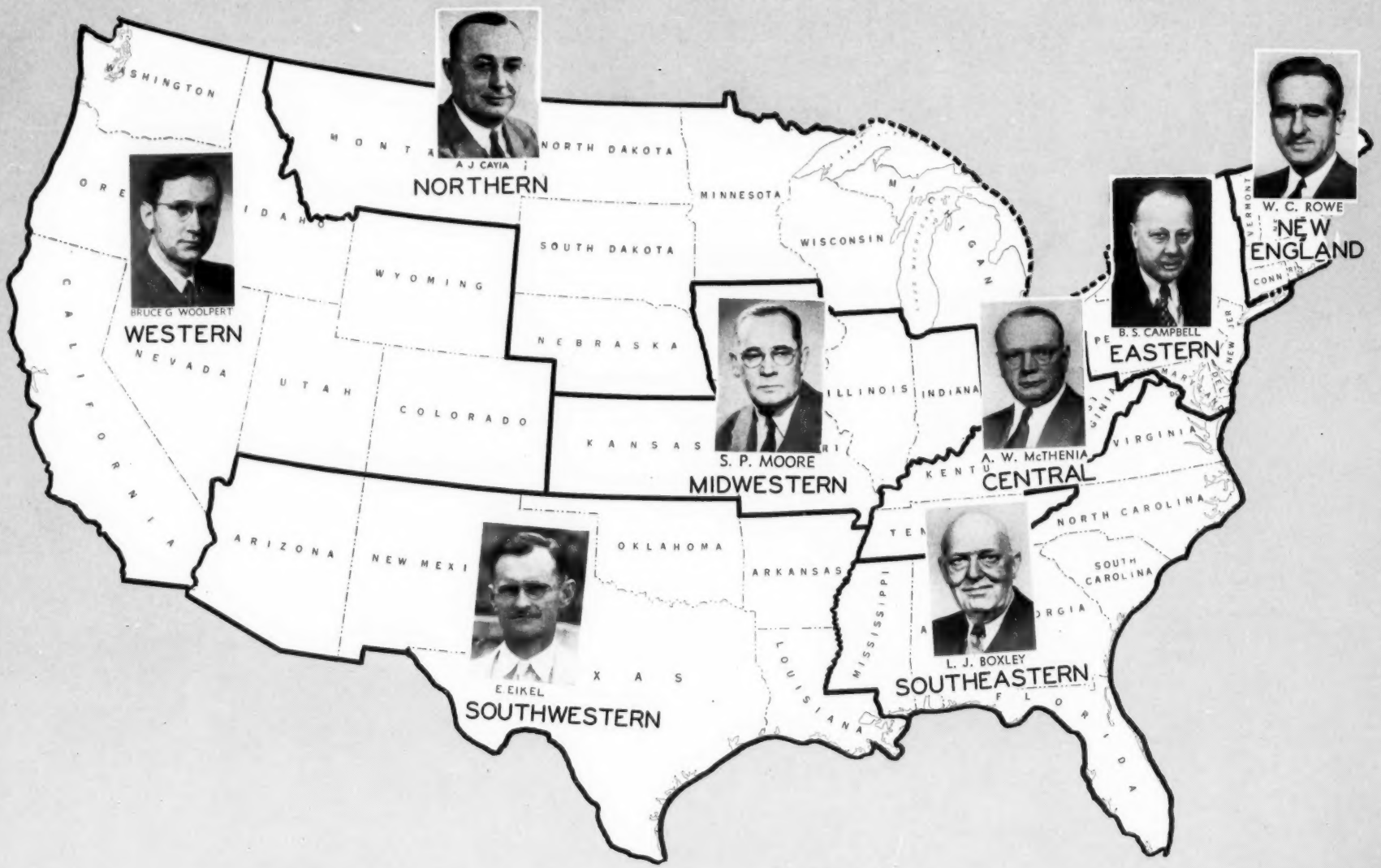
In This Issue

March 1953

- New York Convention Draws Over 800
- F. O. Earnshaw—In Memoriam
- Some Straws in the Wind
- Thomas H. MacDonald to Retire As Commissioner of Public Roads
- Current Practices in Use of Quarry Fines in Bituminous Concrete
- Maintenance and Its Tie-In With Safety

OFFICIAL PUBLICATION · NATIONAL CRUSHED STONE ASSOCIATION

MAP SHOWING REGIONS AND REGIONAL VICE PRESIDENTS FOR 1953
NATIONAL CRUSHED STONE ASSOCIATION



The Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

J. R. BOYD, Editor

NATIONAL CRUSHED STONE ASSOCIATION

1415 Elliot Place, N. W.
Washington 7, D. C.

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NOTICE

For those who keep permanent files of the Crushed Stone Journal, it should be noted that publication was suspended for the December 1952 issue.

H. C. KRAUSE

President
Columbia Quarry Company
St. Louis, Mo.

●

Re-elected President
NATIONAL CRUSHED STONE ASSOCIATION
by the Board of Directors
New York, N. Y.

February 1, 1953

IRWIN F. DEISTER

Vice President
Deister Machine Company
Fort Wayne, Ind.

●

Re-elected Chairman
MANUFACTURERS DIVISION
at its Annual Meeting
New York, N. Y.

February 3, 1953

THE CRUSHED STONE JOURNAL

WASHINGTON, D. C.

Vol. XXVIII No. 1. PUBLISHED QUARTERLY MARCH 1953

New York Convention Draws Over 800

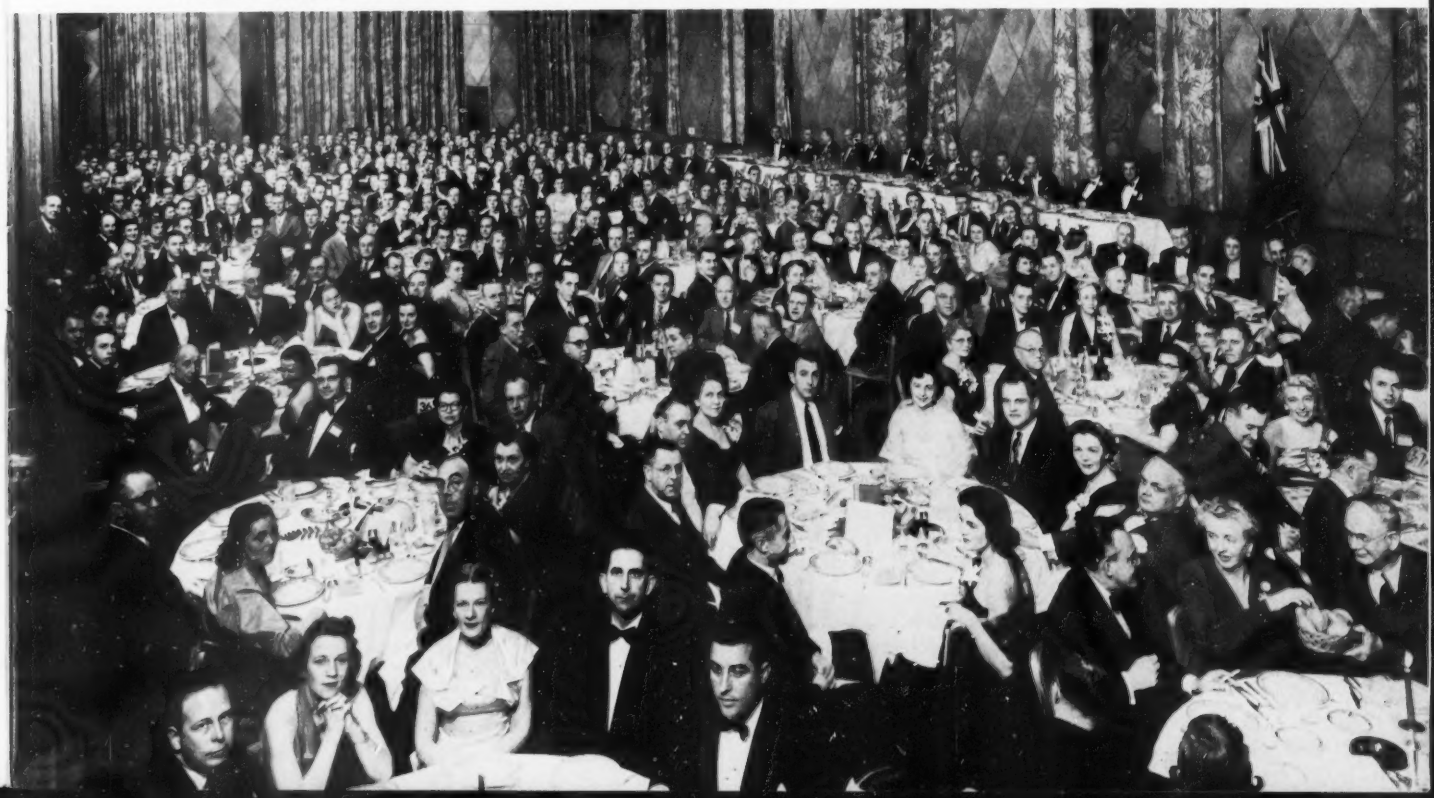
COMING from all sections of the United States and from Canada, in excess of 800 delegates met at the Hotel New Yorker, New York City, on February 2, 3, and 4, 1953, for the 36th Annual Convention of the National Crushed Stone Association. It is interesting to note that when last a convention was held in New York in 1949 the registration was about 700. Obviously, therefore, a new attendance record for New York was established, clearly indicating its growing popularity as a location for our annual meeting.

The program for the Convention was exceptionally well received as judged by the large attendance and the sustained interest at each session. Much credit is due to the Convention Arrangements Committee, under the able Chairmanship of Otho M. Graves, for its very great contribution to the success of the meeting in arranging such an outstanding program.

The social side of the Convention was made even more enjoyable than in years past through the pleasingly large attendance of over 100 ladies, who by their presence contributed much to the pleasure of the buffet dinner and cocktail party on Monday evening, and the annual banquet on Wednesday.

The pictorial presentation of quarry operations by slides and movies given on Wednesday was received with great enthusiasm and seems certain to become a major feature of the program for conventions held in off-show years. The scheduling of this part of the program imposed many difficulties which were effec-

Annual Banquet National Crushed Stone Association, Hotel New Yorker, N. Y., February 4, 1953



H. C. KRAUSE
Columbia Quarry Co.
St. Louis, Mo.
President
National Crushed Stone Association

J. REID CALLANAN
Callanan Road Improvement Co.
South Bethlehem, N. Y.

T. C. COOKE
Lynn Sand and Stone Co.
Swampscott, Mass.

EXECUTIVE COMMITTEE

of the

NATIONAL CRUSHED STONE ASSOCIATION

for the year 1953

IRWIN F. DEISTER
Deister Machine Co.
Fort Wayne, Ind.
Chairman
Manufacturers Division

WILSON P. FOSS, III
New York Trap Rock Corp.
New York, N. Y.

OTHO M. GRAVES
General Crushed Stone Co.
Easton, Pa.
Honorary Member

S. P. MOORE
Concrete Materials and Construction Co.
Cedar Rapids, Iowa

RUSSELL RAREY
Marble Cliff Quarries Co., Columbus, Ohio

W. S. WESTON, JR.
Weston & Brooker Co.
Columbia, S. C.

W. F. WISE
Southwest Stone Co.
Dallas, Texas

tively solved by the painstaking efforts of Dexter Bullard, George Lott, and Seymour Fleming, to whom we are indebted for a smooth running show. Consideration is already being given to possible improvements which can be made in this type of presentation.

The papers and discussions on practical operating problems presented at the Monday afternoon and Wednesday morning sessions are now being prepared for publication in pamphlet form and will be released as soon as possible. Other talks of lasting benefit will be made available in either mimeographed form or through the columns of the Crushed Stone Journal.

To all of the speakers who so ably contributed to the success of our 36th Annual Convention, and to those members who had the responsibility of presiding at the various sessions, there is extended sincere thanks.

In the following there are reported the results of the various elections and certain events which took place, believed to be of particular interest.

Horace C. Krause Re-Elected President

On Sunday, February 1, 1953, the new Board of Directors, elected by mail ballot prior to the Annual Convention, held its organizing meeting.

As the first order of business Horace C. Krause, President of Columbia Quarry Company, St. Louis, Missouri, was re-elected President of NCSA, to serve a second term. All members of the Board eligible to serve were placed in nomination for election to the Executive Committee and by secret ballot the seven receiving the highest number of votes were declared elected. In addition, Otho M. Graves was re-elected an honorary member of the Executive Committee. With the President of NCSA and the Chairman of the Manufacturers Division, ex officio members, the full personnel of the Executive Committee is as follows:

NEWLY ELECTED TO BOARD OF DIRECTORS—NCSA

R. E. SANSOM
American Limestone Co.
Knoxville, Tenn

R. S. REIGELUTH
New Haven Trap Rock Co.
New Haven, Conn.

Executive Committee

H. C. Krause, Columbia Quarry Co., St. Louis, Mo., *Chairman*
J. Reid Callanan, Callanan Road Improvement Co., South Bethlehem, N. Y.
T. C. Cooke, Lynn Sand & Stone Co., Swampscott, Mass.
Irwin F. Deister, Deister Machine Co., Fort Wayne, Ind.
Wilson P. Foss, III, New York Trap Rock Corp., New York, N. Y.
Otho M. Graves, General Crushed Stone Co., Easton, Pa.
S. P. Moore, Concrete Materials & Construction Co., Cedar Rapids, Iowa.
Russell Rarey, Marble Cliff Quarries Co., Columbus, Ohio
W. S. Weston, Jr., Weston & Brooker Co., Columbia, S. C.
W. F. Wise, Southwest Stone Co., Dallas, Texas

Meeting of Newly Elected NCSA Board of Directors

IRWIN F. DEISTER
Deister Machine Co.
Fort Wayne, Ind.
Chairman
Manufacturers Division

L. A. EIBEN
Northern Blower Co.
Cleveland, Ohio

EXECUTIVE COMMITTEE

of the

MANUFACTURERS DIVISION

National Crushed Stone Association

for the year 1953

WAYNE W. KING
W. S. Tyler Co.
Cleveland, Ohio

H. C. KRAUSE
Columbia Quarry Co.
St. Louis, Mo.
President
National Crushed
Stone Association

B. R. MALONEY
E. I. du Pont
de Nemours & Co.
New York, N. Y.

J. CRAIG MCLANAHAN
McLanahan & Stone
Corp.
Hollidaysburg, Pa.

Elected to honorary membership on the Board of Directors were F. O. Earnshaw, H. E. Rodes, Stirling Tomkins, and Harold Williams.

Other officers elected for the ensuing year included James Savage, Treasurer; A. T. Goldbeck, Engineering Director; J. R. Boyd, Administrative Director and Secretary; and J. E. Gray, Field Engineer.

Upon being advised that circumstances had developed since the mail ballot election, which created a vacancy in the office of Regional Vice President for the Western Region, the Board of Directors appointed to this office Bruce G. Woolpert of the Granite Rock Company, Watsonville, California.

JAMES SAVAGE
Buffalo Crushed Stone Corp., Buffalo, N. Y.
Re-elected Treasurer

Irwin F. Deister Re-Elected Chairman of Manufacturers Division

The annual business meeting and luncheon of the Manufacturers Division, held on Tuesday, February 3, was very well attended with some 140 representatives of member companies present.

The principal business to come before the annual meeting of the Manufacturers Division was the election of officers for the ensuing year.

The report of the Nominating Committee, submitted by Craig McLanahan, Chairman, was unanimously adopted and resulted in the election of the following to the offices as designated:

Chairman

Irwin F. Deister, Deister Machine Co., Fort Wayne, Ind.

Vice Chairmen

L. A. Eiben, Northern Blower Co., Cleveland, Ohio
Wayne W. King, W. S. Tyler Co., Cleveland, Ohio
B. R. Maloney, E. I. du Pont de Nemours & Co., Inc., New York, N. Y.

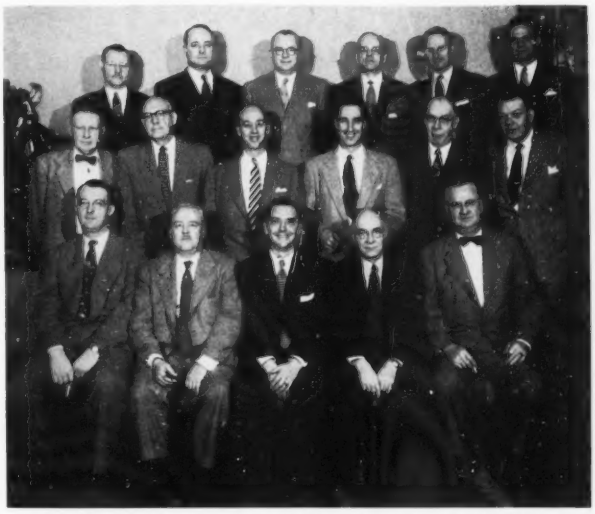
Representatives on NCSA Board

Wayne W. King, W. S. Tyler Co., Cleveland, Ohio
J. Craig McLanahan, McLanahan & Stone Corp., Hollidaysburg, Pa.

Directors

D. McM. Blackburn, Hendrick Mfg. Co., Carbondale, Pa.
J. B. Bond, Nordberg Mfg. Co., Milwaukee, Wis.
W. E. Collins, Jr., Atlas Powder Co., Wilmington, Del.
R. M. Dickey, Bucyrus-Erie Co., South Milwaukee, Wis.
C. R. Dodge, Northwest Engineering Co., Chicago, Ill.
G. P. Fenn, Caterpillar Tractor Co., Peoria, Ill.
G. D. Fraunfelder, Easton Car & Construction Co., Easton, Pa.
J. W. Hardesty, Baldwin-Lima-Hamilton Corp., Lima, Ohio
H. R. Harrington, Goodyear Tire & Rubber Co., Inc., Akron, Ohio
G. C. Holton, American Cyanamid Co., New York, N. Y.
G. H. Keppel, C. G. Buchanan Crushing Machinery Div., Birdsboro Steel Foundry and Machine Co., Birdsboro, Pa.
R. D. Ketner, General Electric Co., Schenectady, N. Y.
K. F. Lange, Link-Belt Co., Chicago, Ill.
H. W. Newton, Barber-Greene Co., Aurora, Ill.
L. A. Rhodes, Jeffrey Manufacturing Co., Columbus, Ohio
W. A. Rundquist, Pioneer Engineering Works, Inc., Minneapolis, Minn.
A. E. Schneider, Stedman Foundry & Machine Co., Inc., Aurora, Ind.

(Continued on Page 9)



Members of New Board Manufacturers Division, Present at 1953 Annual Meeting

Top Row, standing left to right:

C. S. WEBER, Advertising Manager, Thew Shovel Co., Lorain, Ohio.
R. M. DICKEY, Sales Manager, Large Machines, Bucyrus-Erie Co., South Milwaukee, Wis.
A. E. SCHNEIDER, President & General Manager, Stedman Foundry & Machine Co., Inc., Aurora, Ind.
H. R. HARRINGTON, Assistant Manager, Belting Department, Goodyear Tire & Rubber Co., Inc., Akron, Ohio.
W. A. RUNDQUIST, Sales Promotion Manager, Pioneer Engineering Works, Inc., Minneapolis, Minn.
G. H. WOODLAND, Sales Manager, Chain & Transmission Div., Chain-Belt Co., Milwaukee, Wis.

Middle Row, standing left to right:

D. McM. BLACKBURN, Plant Manager, Hendrick Manufacturing Co., Carbondale, Pa.
H. W. NEWTON, Assistant Sales Manager, Barber-Greene Co., Aurora, Ill.
R. D. KETNER, General Electric Co., Schenectady, N. Y.
J. CRAIG MCLANAHAN, General Manager, McLanahan & Stone Corp., Hollidaysburg, Pa.
G. C. HOLTON, Manager, Explosives Department, American Cyanamid Co., New York, N. Y.
W. E. COLLINS, JR., Director of Sales, Atlas Powder Co., Wilmington, Del.

Seated, left to right:

L. A. EIBEN, President, Northern Blower Co., Cleveland, Ohio.
WAYNE W. KING, Assistant Vice President, W. S. Tyler Co., Cleveland, Ohio.
IRWIN F. DEISTER, Vice President, Deister Machine Co., Fort Wayne, Ind.
J. R. BOYD, Secretary, Manufacturers Division, National Crushed Stone Association, Washington, D. C.
B. R. MALONEY, Manager, Explosives Department, E. I. du Pont de Nemours & Co., Inc., New York, N. Y.

NEWLY ELECTED TO MANUFACTURERS DIVISION BOARD

R. M. DICKEY
Bucyrus-Erie Co.
S. Milwaukee, Wis.

GEORGE D. FRAUNFELDER
Easton Car &
Construction Co.
Easton, Pa.

J. W. HARDESTY
Construction
Equipment Div.
Baldwin-Lima-
Hamiton Corp
Lima, Ohio

GILFRY WARD
American Manganese
Steel Div.
American Brake
Shoe Co.
Chicago, Ill.

C. S. WEBER
Thew Shovel Co.
Lorain, Ohio

G. H. WOODLAND
Chain Belt Co.
Milwaukee, Wis.

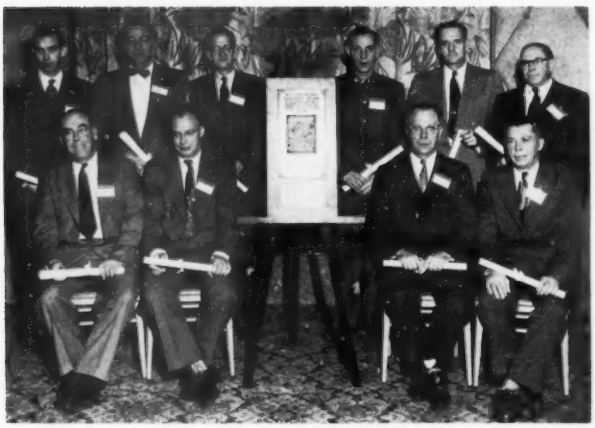
Manufacturers Division Annual Business Meeting Luncheon, Hotel New Yorker, New York, N. Y., February 3, 1953

C. Darrell Smith, Joy Manufacturing Co., Pittsburgh, Pa.
V. L. Snow, Euclid Road Machinery Co., Cleveland, Ohio
Gilfry Ward, American Manganese Steel Div., American Brake Shoe Co., Chicago, Ill.
C. S. Weber, Thew Shovel Co., Lorain, Ohio
G. H. Woodland, Chain Belt Co., Milwaukee, Wis.

It will be recalled that in addition to elected Directors, the Chairman, Vice Chairmen, Representatives on the NCSA Board of Directors, and President of NCSA are ex officio members of the Board of the Manufacturers Division. The officers, other than the Directors, comprise the Executive Committee of the Division.

Irwin F. Deister, Chairman of the Manufacturers Division, will serve as an ex officio member representing the Manufacturers Division on the Board of Directors and the Executive Committee of the National Crushed Stone Association.

Winners of NCSA Safety Contest for 1951



Standing, left to right:

E. P. Snyder, Safety Supervisor, Security Quarry, North American Cement Corp., Hagerstown, Md.

J. G. Wilson, General Superintendent, Cedar Hollow Division, Warner Co., Bridgeport, Pa.

Fred Warner, General Superintendent, Bell Underground Limestone Mine, Warner Co., Bellefonte, Pa.

Harvey P. Jones, Superintendent, Auburn Quarry, General Crushed Stone Co., Auburn, N. Y.

Merl Price, Superintendent, LeRoy Quarry, General Crushed Stone Co., LeRoy, N. Y.

Oliver C. Dietschler, Superintendent, Jordanville Quarry, General Crushed Stone Co., Jordanville, N. Y.

Seated, left to right:

John H. McKernan, Superintendent, Middlefield No. 1 Quarry, New Haven Trap Rock Co., Middlefield, Conn.

Charles F. Bass, Superintendent, Plainville No. 4 Quarry, New Haven Trap Rock Co., Plainville, Conn.

A. W. Heitman, General Superintendent, Port Inland Quarry, Inland Lime and Stone Co., Gulliver, Mich.

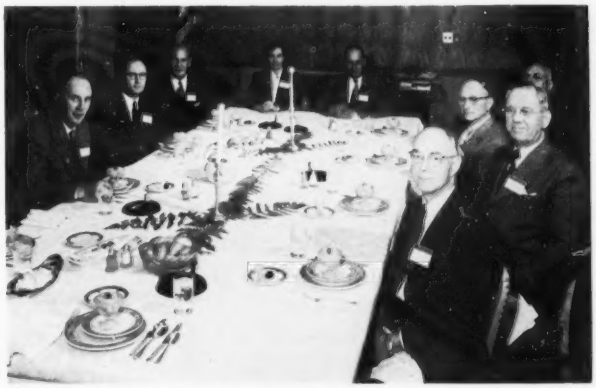
Edgar Z. Cole, Superintendent, Rock Hill Quarry, General Crushed Stone Co., Quakertown, Pa.

Safety Contest Winners Receive Awards at Wednesday Luncheon

In a brief but impressive ceremony awards were made at the general luncheon on Wednesday to representatives of the winning plants in the National

(Continued on Page 23)

Accident Prevention Committee—Dinner Meeting Hotel New Yorker, New York, N. Y. February 3, 1953

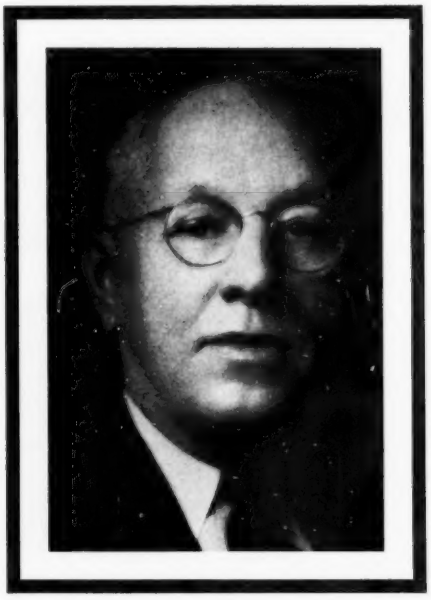


Clockwise around the table, starting at the left:

S. B. Fleming, Safety Engineer, New York Trap Rock Corp., New York, N. Y.
H. H. Kirwin, Treasurer, Eastern Rock Products, Inc., Utica, N. Y.
H. C. Krause, President, Columbia Quarry Co., St. Louis, Mo.
B. G. Gay, Administrative Assistant, National Crushed Stone Association, Washington, D. C.
C. A. Gustafson, Superintendent, Callanan Road Improvement Co., South Bethlehem, N. Y., *Chairman*
T. W. Jones, Production Manager, New Haven Trap Rock Co., New Haven, Conn.
H. F. Yotter, Insurance Supervisor, General Crushed Stone Co., Easton, Pa.
H. E. Rainer, Manager, Federal Crushed Stone Corp., Buffalo, N. Y.
J. R. Boyd, Administrative Director, National Crushed Stone Association, Washington, D. C.

C. A. Gustafson, Chairman NCSA Accident Prevention Committee, congratulates A. W. Heitman, Inland Lime and Stone Co., on winning NCSA Safety Trophy

1875



1953

Frederick Ono Earnshaw
In Memoriam

His legion of friends in the crushed stone industry, and particularly in the National Crushed Stone Association, will be deeply saddened to learn of the death of Fred O. Earnshaw which took place on March 3, 1953, at his home in Hillsville, Pennsylvania, following a heart attack. While "Fred," as he was affectionately known to his many friends, had not been in good health for several years, his passing was shockingly unexpected.

Fred Earnshaw was born on June 18, 1875, in Morris, Illinois, his forebears having come from England, where for several generations they had quarry interests. Following his education at Wheaton College and at the Chicago School of Business, he was connected with the Western Stone Company in Joliet, Illinois, and then with his father established the Earnshaw Stone Company in Lamont, Illinois. He then moved to the France Stone Company of Sandusky, Ohio, and in 1918 joined the Carbon Limestone Company as superintendent of its Hillsville, Pennsylvania, quarry, finally to become its President in which capacity he served until his retirement a few years ago. Under his direction many technical developments were inaugurated including the first wagon drill, one of the earliest washers, and a power dump now used on many well-known makes of quarry cars.

He became actively identified with the affairs of the National Crushed Stone Association when in 1928 he was elected to its Board of Directors. He served as Regional Vice President in 1942 and 1943, was a member of its Executive Committee from 1942 to 1946, and was accorded the highest honor within the power of the industry to bestow when he was elected President of the National Crushed Stone Association in 1944 and 1945. In 1949 Mr. Earnshaw was made an Honorary Member of the Board of Directors, which distinction he enjoyed until the time of his death.

Fred Earnshaw was a loyal and devoted supporter of the National Crushed Stone Association; generous, and ever willing to do his utmost in behalf of the organization in which he played so active a part for over a quarter of a century. Fred and his wife, Flossie, invariably attended our annual meetings where they made a real and personal contribution to the enjoyment of these occasions.

He is survived by his wife, the former Florence Beck of Lockport, Illinois; two daughters, Mrs. Richard C. Shepherd of Elkins, West Virginia, and Mrs. Charles Coburn of Milwaukee, Wisconsin; and six grandchildren.

Some Straws in the Wind[1]

By A. T. GOLDBECK

Engineering Director
National Crushed Stone Association
Washington, D. C.

THIS morning, instead of telling you what we are doing, I propose to talk to you on the subject "Some Straws in the Wind." What technical matters are "in the wind" which may affect the use of crushed stone. I shall purposely avoid production problems, for those will be covered by experts at our sessions for superintendents and operating men.

Aggregate Specifications

Let's talk first about aggregates. You sell your material to meet certain specifications and hence you have a really vital interest in specifications for aggregates. Many local standards are based on those written by the American Society for Testing Materials and, therefore, those specifications exert considerable influence on your business.

Recently a new Tentative Specification for Aggregates was adopted by the ASTM which contains some innovations. For the first time, the possibility of alkali-aggregate reactivity, as applied to both fine and coarse aggregates, has been recognized in these specifications. To refresh your memory, all portland cements contain alkalis, sodium or potassium, which the chemist always reports as sodium oxide and potassium oxide. Cements from different mills, depending largely on the raw materials used, contain different amounts of alkalis, varying from a few tenths to around one per cent. Certain aggregates contain silica in a form, such as opal, which combines with these alkalis in the cement and alkali silicates are formed. You are all familiar with one of them, sodium silicate or water-glass. These alkali silicates in some way exert internal pressure in the concrete, expand it, causing so-called map cracking, excessive expansion, and ultimate failure. And so, in an attempt to prevent this undesired effect, the new tentative ASTM specification contains a new section which reads:

> "Coarse aggregate for use in concrete that will be frequently wet should be free of material that could react harmfully with alkalis in the cement. If such materials are present in injurious amounts, the coarse aggregate shall be rejected, or be used with a cement containing less than 0.6 per cent alkalis calculated as sodium oxide or with the addition of a material that has been shown to inhibit undue expansion due to alkali-aggregate reaction."

That specification, despite its saving clauses, for some aggregate producers is going to be a difficult one to meet. Cement from some sections of the country invariably contains more than 0.6 per cent of alkali. If several aggregates are available in that locality, one of which contains reactive material, with it must be used an expansion inhibiting material such as fly ash, or else low alkali cement must be imported from another locality for use with this particular aggregate. This immediately introduces difficulties in competition with the acceptable aggregates. And so these qualifying and presumably saving clauses in the specification do not help the slightly reactive aggregate at all. Fortunately, the specification is tentative and, further, there are developments which show that this so-called alkali aggregate reaction, in many respects, is still a mystery, and it seems to be tied in with the compound composition of the cement.

One school claims that the lime in the cement, which is always present in concrete when it is wet, is needed to make the alkali-aggregate reaction a continuing one and that a harmful amount of alkali could not otherwise be released without the action of the lime. Certainly it is known that the cement composition has a controlling influence, so much so that merely by using a Type II instead of a Type I cement of the same brand, the extent of the objectionable reaction may, in some cases, be very greatly decreased.

More investigative work is needed to tie in cement composition with this expansion difficulty. Certainly there is a more satisfactory solution of this expansion problem than to exclude a given aggregate which contains a small amount of silica in undesirable form when used with some cements, but which has no expanding effect when used with other cements. There is trouble ahead for some aggregate producers unless the alkali-aggregate expansion problem is solved in a proper manner.

[1] Presented at the 36th Annual Convention of the National Crushed Stone Association held at the Hotel New Yorker, New York, N. Y., February 2-4, 1953

In this same ASTM specification, the Los Angeles abrasion loss is set at a limiting value of 50 per cent with, however, the stipulation that softer material may be used if satisfactory concrete strength may be obtained when using the concrete proportions selected for the work. This specification is typical of national specifications covering a wide range of aggregates rather than a narrow range such as may exist locally.

The gradation requirements in the ASTM specification have not been changed and are still those of the Division of Simplified Practice of the Department of Commerce.

Oddly enough, no mention is made of flat and elongated pieces, and no doubt the reason is that not too much is known about the real effect on concrete of flat and elongated pieces in the aggregate. Only by being arbitrary can one write a definite value for flat and elongated pieces into an aggregate specification. Some specifications having a "flat and elongated" requirement are unrealistic and, for that reason, a numerical restriction is usually avoided and the less restrictive phrase "free from an injurious amount of flat and elongated pieces" is used.

There will be a chance to revise these Tentative ASTM Aggregate Specifications where they are lacking in some respect.

Prestressed Concrete

During the last few years we have heard a lot about the growing use of prestressed concrete in this country. In explanation, remember that concrete is a material which is strong in compression, but relatively weak in tension. When a plain, unreinforced concrete beam is broken it always breaks first on the tension side. For that reason, reinforcing steel is used to take care of the internal tensile forces or "stresses" in the concrete. When a floor beam is loaded it bends down in the middle and the lower portion of the beam is placed under tensile stress and the upper portion is in compression. Steel reinforcing bars, in this case, are located in the lower part of the beam to properly resist the tensile stresses.

Prestressed concrete differs from ordinary reinforced concrete in that the reinforcing steel, generally of very high elastic limit and strength, is placed in the beam in a stretched or stressed condition and is held in that condition until after the concrete has hardened, when the pulling force at the end of the steel is released and immediately the tension in the steel compresses the concrete. When such prestressed beams are loaded, these induced compressive stresses in the concrete are reduced as the concrete stretches along with the steel, but not until that compression is entirely released will the concrete begin to be stressed in tension. Simultaneously, there is a tendency for the upper half of the beam to be placed in tension by the prestressing of the steel and, under load, this tension is relieved and becomes compression. Thus, it is evident that prestressing makes for the economic use of materials required to support a given load.

I call prestressing to your attention because it is relatively new and it can affect our industry. In this type of construction it is advantageous to use concrete which is extraordinarily high in strength and which will maintain high rigidity with a minimum of plastic flow, which would tend to relieve part of the prestress in the steel and thus cause a relaxation of stress. Stone generally is an excellent aggregate for prestressed concrete because when a rich concrete mixture is used with resistant stone, high strength and rigidity are almost sure to result, and both are excellent qualities in prestressed concrete. Incidentally, the word "prestressing" is sometimes used when "post-stressing" is the correct term. When stress is applied to the steel after the concrete has hardened, that is "post-stressing."

Slippery Pavements

There is one storm which has been rumbling for several years and in some states the lightning already has struck. I speak of the problem of slippery pavements. Some stone sand concrete pavements have been definitely proven to become slippery in a relatively short time. Apparently, what happens is that the initially projecting particles of stone sand become worn to a mosaic flat surface so that the fine aggregate has no "tooth" to provide traction. Especially in the first stages of a rain when the surface is damp, the coefficient of friction between tire and surface is reduced to a dangerously small value.

Tests for slipperiness are conducted in the field in several ways, one of which is to measure the stopping distance of an automobile initially traveling at a known speed. The brakes are applied with enough force to slide the wheels. For all practical purposes the work done in stopping the car equals its

kinetic energy when the brakes were applied and this fact can be expressed in mathematical form as follows:

$$fW \times d = \frac{1}{2}\frac{W}{g}v^2 \quad \text{or} \quad f = \frac{v^2}{2gd} \quad \text{where}$$

f = coefficient of friction
W = weight of vehicle in pounds
g = acceleration of gravity = 32.2
v = velocity in feet per second of vehicle when brakes were applied
d = distance in feet to bring vehicle to rest

Thus, suppose the vehicle weighed 4,000 lb. = W

v = 30 ft. per sec. (about 20.4 miles per hour)
d = 20 ft. = distance, then

$$f = \frac{30 \times 30}{2 \times 32.2 \times 20} = 0.7$$

Suppose the distance required were 40 ft., then the coefficient of friction

$$f = \frac{30 \times 30}{2 \times 32.2 \times 40} = 0.35$$

A value for f of 0.40 is considered to be the limit of safety.

Certain stone sands have been discontinued for use in concrete pavements because of too many skidding accidents and it is well for those of you who are contemplating the sale of stone sand for pavements to bear this fact in mind.

If objection is made to stone sand in bituminous mixes, a substitution for a part, say up to 50 per cent of natural siliceous sand would be very beneficial in overcoming slipperiness. However, its use is not always necessary, for entirely satisfactory bituminous concrete can be, and very frequently is, made with an all crushed aggregate.

Graded Aggregate Base Course

On our convention program, there is a paper by C. E. Proudley dealing with the graded aggregate type of base course. He will describe a particular road project, but this same type of construction is used either under a bituminous concrete top or a portland cement concrete surfacing. Many of you have been producing agricultural limestone and, temporarily at least, the market for this material has been reduced. You no doubt are interested in a continuing outlet for this fine material, together with the coarser portion of your output. This country is in dire need of a very greatly expanded road program, unfortunately at a time when costs are at their peak. Obviously, then, any plan that will build large mileage at relatively low cost would help greatly to extend the highway transportation system.

The graded aggregate base course, which has been growing in use, seems to hold promise of providing a relatively inexpensive type of base which, when covered with a wear resistant surface such as bituminous concrete or portland cement concrete, becomes a pavement capable of carrying the heaviest of traffic.

The gradation of the graded aggregate base or sub-base under a durable wearing surface has been the subject of some engineering debate. On the one side is that group which would use a gradation so dense that it is impermeable, so that the water percolating through joints in the pavement is not allowed to reach the subgrade, which then is supposed to maintain its stability constantly. Others want a drainable sub-base, in which case the sub-base is best carried out to the ditches, thus providing prompt drainage laterally for any water which percolates down from above.

The dense type retains water under the pavement and probably is softened to some extent, notwithstanding its dense and presumably stable gradation, while the more open gradation is little affected by water which percolates through cracks or joints in the surface. The dense gradation is subject to capillary action from the subsoil, the open gradation very much less so.

It is interesting to note that the recent specifications for the Pennsylvania Turnpike foundation layer under their concrete pavement call for the drainable type and, to insure the direct drainage, this layer is carried clear out to the ditches.

Typical gradations of the two types of base course, both having a one inch maximum size, are as follows:

Sieve Size (square openings)	Total Passing, per cent	
	Dense	Drainable
1 in.	100	100
3/8 in.	72	61
No. 4	57	43
No. 16	36	22
No. 30	28	15
No. 50	21	10
No. 100	18	8
No. 200	14	5

$$p = 100\sqrt[3]{\frac{d}{D}} \qquad p = 100\sqrt{\frac{d}{D}}$$

Both are based on Talbot's Formula $p = 100\sqrt[n]{\frac{d}{D}}$ where $n = 3$ in the case of the dense gradation and $n = 2$ in the case of the drainable gradation. Obviously, because of the lesser quantity of "fines," the gradation in the third column is the more drainable of the two. The above gradations will differ depending on the maximum size of the aggregate used, but they may be readily calculated using the formula above given. The Pennsylvania Turnpike Commission has selected 2 1/2 in. as the maximum size in its drainable type of sub-base. Both types of gradations are apt to be used in future construction and this is something for the stone industry to think about. This is not so-called "crusher-run" material and generally it must be made by properly proportioning several different sizes which will depend on the gradation required and on the plant sizes produced.

Something New in Asphalt Content Determination

During the past year or more, our laboratory has been looking into what promises to be a quick, useful method for determining the asphalt content of a finished asphaltic mix without the time-consuming method of extracting the asphalt. This method is too technical to discuss in detail. However, it depends on the measurement of the solid volume (as contrasted to bulk volume) of a sample of *loose* bituminous mix. Knowing the volume and weight, the density may be computed. This density is then compared with that of a mix with a known asphalt content and any difference indicates a difference in asphalt content.

Two methods have been investigated for measuring the solid volume of mixtures. In the first, which is particularly useful for small laboratory samples, the volume is determined by water displacement after thoroughly evacuating entrapped air bubbles. The second method, which could be more readily used at asphalt plants, utilizes a pressure meter such as is used for the measurement of entrained air in fresh concrete.

Ballast Tests

Railroad ballast furnishes a considerable market for stone and it is interesting to know that there is a trend toward the use of smaller sizes than the 3/4 to 2 1/2 in. size formerly used. The reason given by the railroad engineers is that they can more readily maintain the track in a smooth condition by the use of a smaller "lift." So, the continuation of that trend is in the air. Also, there seems to be a growing feeling that the Los Angeles abrasion test now specified by the AREA may not be entirely adequate for testing ballast and investigations are now under way by the AREA research organization to look into this matter. They are using a special, repeated load, applying machine, simulating the action of loads frequently applied to the track. What may come out of this test series no one knows, but I should not be surprised to see more stringent specifications for ballast, especially as applied to cementing value. There have been some complaints that different rocks having the same Los Angeles value do not behave alike in the track—some cement and interfere with drainage, others do not. Possibly there will be a return to some form of the old cementing value limitation. If so, certain ballast producers may expect trouble.

Construction Possibilities of This Coming Year

A boom year for construction has been predicted by experts and their predictions are backed by the U. S. Departments of Commerce and Labor, provided business in general remains good and that, as anticipated, there will actually be increasing defense expenditures during the first half of the year. It is predicted that construction in 1953 will total $33.3 billion, including $22.2 billion in private construction. This represents an increase over last year which, however, will be offset by a falling off in industrial construction from $2.3 billion to $1.9 billion. Public works construction, including public and defense housing, hospital, military and naval construction, highways, sewers, and water works, will show an increase, particularly in hospitals and military construction. A $3 billion highway program is estimated. So, if the predictions materialize, this year promises an enormous construction program in which crushed stone will share.

Fifth Short Course

Let me depart from our general theme of "Straws in the Wind" to report to you on the Fifth Short Course which we recently held in Washington. This course was very successful. We had speakers of national, and even international, reputation. The Course was well attended by our member companies. Some 37 companies were represented, with 101 representatives. Also, we had 61 engineers from 6 State

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Thomas H. MacDonald to Retire As Commissioner of Public Roads

AFTER nearly thirty four years of outstanding service to the nation, Thomas H. MacDonald, head of the Bureau of Public Roads of the Department of Commerce, will retire on March 31, 1953.

Mr. MacDonald has directed the work of the federal road building organization since 1919, first as Chief of the Bureau of Public Roads, and since 1939 as Commissioner of Public Roads. He has been responsible for administration of federal highway funds since shortly after the beginning of federal participation in highway matters on a national scale. He greatly influenced the formulation of national highway policy and gave skilled direction to the plan of federal-state cooperation in highway improvement.

At the time of his appointment to take charge of the Bureau of Public Roads in 1919 plans were being developed for administering the Federal-Aid Road Act of 1916 which marked the beginning of federal assistance to the states in highway improvement.

He immediately sought the advice and assistance of state officials, acting through the American Association of State Highway Officials, in developing federal-aid procedure and consistently followed this practice in the development of highway policies, specifications and standards. When he took office the plan of federal-state cooperation was an untried venture. It has been successful beyond all expectations. When it was initiated there were no surfaced roads interconnecting the large cities of the country. Industries were located alongside the rail terminals. The farmer was isolated from city life. Federal assistance to the states launched them upon programs that have made a complete change in all of these conditions.

The federal-aid highway system was authorized in 1921 and the Bureau began its work of bringing the states into agreement on a coordinated system to serve the entire country. Differing views as to where routes should cross state lines produced difficult problems but all were solved.

In connection with designation of the federal-aid system, inquiry was made of the War Department as to which of the highways were considered to be of principal strategic importance in event of war. It was desired to include those roads of greatest importance to national defense in the system being selected. The War Department submitted a map approved by General Pershing. The routes shown on the map were included in the system, and were improved in the following years. On numerous other occasions Mr. MacDonald requested the advice of defense officials and was guided by their recommendations.

In 1924 the Bureau placed special emphasis on elimination of the hazard at railroad grade crossings and urged the states to adopt grade-crossing elimination programs. Thousands of crossings have been eliminated in the federal-aid program.

Mr. MacDonald was one of the small group instrumental in establishing the Highway Research Board of the National Research Council in 1919 and has served as ex officio member of the executive committee of the Board since its first meeting in 1923. He has been an active participant in the broad research program of the Board which has had great impact on highway development.

In 1924 Mr. MacDonald was designated Chairman of the Joint Board on Interstate Highways appointed by the Secretary of Agriculture at the request of the American Association of State Highway Officials. The Board was composed of 3 federal and 21 state representatives. Through a series of national and regional meetings, agreement of all the states was obtained on routes to comprise the U. S. numbered system of highways, thereby eliminating the great confusion that had previously existed in route designation, mapping, and marking of routes. The Board also developed the system of standard informational, warning, and danger signs now in use on all highways throughout the country. The Board eliminated the chaos and confusion that had existed in highway designation and marking without the aid of legislation or compulsory action.

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Current Practices in Use of Quarry Fines in Bituminous Concrete[1]

By J. E. GRAY

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IN the field the question has frequently been raised "Are stone screenings a satisfactory aggregate for bituminous concrete?" The answer has varied from a definite "yes" to just as definite a "no," depending upon one's experience. A preliminary study of the problem indicates that it is not screenings, per se, which are at fault, but the trouble is primarily due to the lack of uniformity in gradation.

A couple of years ago, I was making an inspection of roads with a group of engineers. We were traveling over an excellent section of bituminous concrete paving when one of the engineers said that this was one type of construction which was not going to be permitted in the future, namely, bituminous concrete in which the aggregate was composed entirely of screenings. This statement was no sooner made than a road sign appeared saying, "Slow down—Pavement Rough." There, for a distance of about 200 ft. was a pavement so rough that traffic had to slow down to around 15 miles per hour. While a very high percentage of the road was in excellent condition, there were three or four sections so rough that they were to be replaced. The cause of the trouble, instability, was due to segregation in the aggregate. The rough places had an excess of fines.

In another section of the country the same problem appeared in another way. Again, some sections of the pavement were excellent, yet other sections rutted, or "shelled out" under the action of traffic and water. The aggregate had segregated, which resulted in parts of the pavement being open or porous, thereby developing brittleness and lack of toughness and durability.

It is indicated, therefore, that under some circumstances, stone screenings have not been an entirely satisfactory aggregate in bituminous concrete because of variation in gradation.

All specifications for bituminous concrete have as one of their objectives the procuring of aggregate that is well graded from maximum to minimum sizes with as little variation in individual size fractions as possible. In order to accomplish this purpose, three fundamental methods of approach have been used, each of which will be discussed with its relation to the satisfactory use of quarry fines.

First Method—Grading Band Within a Specification

The first method is that used by the Corps of Engineers and some highway departments, which briefly may be described as follows:

A gradation specification is set up for the aggregate, which may have normal ranges in each size. Samples of the aggregate that are proposed for the job are tested for gradation, and if they comply with the specifications, mixes are designed. If the mixes, when tested, meet the design criteria for stability, density, and flow, the gradation of the aggregate used becomes a part of the specifications with very narrow tolerances. In other words, there is no deviation from the job mix formula once it is established.

An example of such an aggregate requirement is shown in Table I.

TABLE I
Example of Grading Band Within a Specification

Sieve Size	Specification	Assumed Aggregate Gradation	Job Mix Gradation Range
	Total Passing, per cent		
3/4 in.	100	100	100
1/2 in.	86–100	92	88–96
3/8 in.	78–90	85	81–89
No. 4	60–73	68	64–72
No. 10	43–57	50	47–53
No. 20	29–43	35	32–38
No. 40	19–33	27	24–30
No. 80	10–20	16	13–19
No. 200	3–6	4	3–5

The job mix range actually becomes the specification. Under this method of control, any type of fine aggregate may be used—screenings, stone sand, natural sand, or a combination of fine aggregates.

[1] Presented at the 36th Annual Convention of the National Crushed Stone Association held at the Hotel New Yorker, New York, N. Y., February 2-4, 1953.

While some highway departments allow a greater range in the specification and the job mix formula than given in the above example, the principle is the same, often described as a band within a band.

Second Method—Blending of Screenings With Natural Sand

The second method permits the use of screenings in bituminous concrete provided that the mix conforms with the design criteria and gradation specification. While several states use this method, it possibly is exemplified best by the practice of the Texas Highway Department which contracts for the laying of over 1 million tons of asphaltic concrete a year.

The design criteria for hot-mix asphaltic concrete, Type D, is an optimum density of 96 per cent with limits of ±2 per cent (minimum 94 per cent, maximum 98 per cent), and a Hveem stability of 35 minimum. The specifications for the gradation of the aggregate require ½ in. maximum size with 50 to 65 per cent retained on the No. 10 sieve, that is, coarse aggregate, and a dust content of 2 to 10 per cent (minus 200 mesh material).

In general, mixes of the type under discussion consist of 60 per cent coarse aggregate, 25 per cent screenings, and 15 per cent blow sand. A typical combination of these aggregates that conforms with the specification is shown in Table II.

In the example, the screenings are well graded as screenings go, but note that practically all pass the No. 10 sieve with the bulk of the material between the No. 10 and No. 40 sieves, and a lack of material in the No. 40 to No. 80 and No. 80 to No. 200 sieve fractions. Also, observe how the blow sand supplies this lacking 40 to 200 mesh material to give a good size distribution in the combined aggregates (10-40, 14.4 per cent; 40-80, 12.2 per cent; and 80-200, 10.2 per cent). Since only 25 per cent of the combined aggregates is composed of screenings, the high amount of dust in the screenings is reduced to the point that variations in the amount of dust in the final mix are of no consequence.

Stone producers exercise considerable care in the preparation of screenings to be used in bituminous concrete in that they are made generally from the secondary crushing operations. None of the screenings from the primary crusher are used. One producer said that the screenings for black top are all made by putting 3 to 8 in. stone through a hammer mill and separating the product on a 10 mesh sieve, thereby producing a fine aggregate of uniform gradation.

The indiscriminate blending of natural sand with screenings is not a solution to the problem, because the use of very coarse sand can increase the voids in the mix. Natural sand should be used in amount and sizes that supply the deficiencies in the screenings. There is one other requirement that should be

TABLE II

Aggregate Composition for Bituminous Concrete Using Stone, Screenings, and Sand

Sieve Size	Stone Total % x 60%		Screenings Total % x 25%		Blow Sand Total % x 15%		Specification	Combined Analysis
5/8 to 1/2 in.	1.0	0.6					0-3	0.6
1/2 to 1/4 in.	56.0	33.6					25-45	33.6
1/4 in. to No. 10	41.0	24.6	1.8	0.4			15-35	25.0
5/8 in. to No. 10							50-65	59.2
No. 10 to No. 40	1.0	0.6	54.7	13.7	0.5	0.1	0-25	14.4
No. 40 to No. 80	0.5	0.3	17.5	4.4	50.2	7.5	5-25	12.2
No. 80 to No. 200	0.5	0.3	12.0	3.0	45.8	6.9	5-25	10.2
No. 200	--	--	14.0	3.5	3.5	0.5	2-10	4.0
Total	100.0	60.0	100.0	25.0	100.0	15.0		

While the specifications do not require it, nevertheless, it is a common practice to use some natural silica sand in the mix. The engineers say that it is always desirable to use some natural sand high in the 40-80 and 80-200 mesh sizes. These sizes are called carrier sizes, which tend to lubricate the mixture, thereby producing a more workable mix. Even though the natural sand is not required, per se, the design criteria of 96 per cent optimum density generally necessitates its use. This natural silica sand that is so widely used is called "blow sand", which is found extensively in the West.

mentioned. That is that no fine aggregates can be blended in stockpile. Sand and screenings must be fed separately to the cold elevator. If a contractor has a three compartment cold bin and has two fine aggregates and two coarse aggregates, he may blend the two coarse aggregates in stockpile, but not the fine aggregates.

Two other factors which make for success of the Texas bituminous concrete program are the size of job and method of control. The minimum size of job is about 8,000 tons and, of course, jobs extend up to very large tonnages. Therefore, the basic idea is to design a good mix and then get the job under way and keep it going at peak efficiency. In order to do this, the state maintains an inspector at the plant who runs gradations on the materials in the hot bins every hour and once a day takes a sample for test of density, stability, and analysis by extraction. As long as the mix has a gradation that is within the specifications, has the proper density and stability, it is accepted.

While a job mix formula is set up and every precaution used against having wide and sudden fluctuations in gradation, the inspector may change the formula if the hourly analyses show a trend toward a finer or coarser gradation. In other words, there is not set up a grading band within the specification limits, but the mix must comply with the design criteria of density and stability, and be within gradation limits of the specification.

Effect of Maximum Size of Coarse Aggregate

This discussion was opened with a description of the performance of an all screenings mix. Probably the greatest factor contributing to the successful use of screenings has been the amount of coarse aggregate used. It will be recalled that about 60 per cent coarse aggregate was used in the Texas mix. The amount of coarse aggregate that can be used depends upon its maximum size. This is shown best in the gradation requirements for dense graded bituminous concrete of the California Highway Department shown in Table III.

Generally speaking, the No. 6 to No. 10 sieve separates the coarse from the fine aggregate in bituminous mixes. The No. 8 will be selected as making the separation in the above gradations. Taking the average of the specifications, the average amount

TABLE III

Effect of Maximum Size on Amount of Fine Aggregate in Dense Graded Bituminous Concrete

Sieve Size	3/4 in. Max.	1/2 in. Max.	3/8 in. Max.	No. 4 Max.
	Total Passing, per cent			
1 in.	100	–	–	–
3/4 in.	95–100	100	–	–
1/2 in.	–	95–100	100	–
3/8 in.	67–85	80–95	95–100	100
No. 4	50–65	57–78	65–85	90–100
No. 8	37–50	42–59	47–65	62–92
No. 30	18–28	21–34	25–39	31–47
No. 200	3–8	4–9	5–12	6–14

of fine aggregate to be used with the various maximum sizes is as follows:

Maximum Size	Total Passing No. 8, per cent
No. 4	77
3/8 in.	56
1/2 in.	51
3/4 in.	44

As the maximum size increases the percentage of fine aggregate required decreases, thereby reducing the effect of variations in the fine aggregate or screenings. For example, let it be assumed that the screenings have a known range in gradation, then calculate the variations on that portion passing the No. 8 sieve for No. 4 and ¾ in. maximum size aggregate in the mix. The results of such a calculation are given in Table IV.

TABLE IV

Effect of Maximum Size on Variation in Gradation of Screenings

Sieve Size	Screenings		No. 4 Max.		3/4 in. Max.	
	Range in Gradation Total Passing, per cent					
	Coarse	Fine	Coarse	Fine	Coarse	Fine
No. 4	100	100	–	–	–	–
No. 8	72	86	77	77	44	44
No. 30	28	42	30	38	17	22
No. 200	9	15	10	14	5	8
	Variation					
No. 30	14		8		5	
No. 200	6		4		3	

Third Method—Manufactured Stone Sand as the Fine Aggregate

The third method is best exemplified by the practice in Ohio. The Ohio Highway Department not only uses very large volumes of bituminous concrete annually, but has been doing this for a number of years so they have developed a procedure by which they obtain a good product on a very practical basis.

Quarry screenings, as such, are not considered a suitable aggregate for bituminous concrete, and their use has not been permitted for a number of years. However, manufactured stone sand is used extensively. The gradation requirements for manufactured stone sand are as follows:

Passing	Retained	Per Cent
No. 4	-	100
No. 4	No. 6	0- 5
No. 6	No. 8	0-10
No. 8	No. 16	15-40
No. 16	No. 50	25-60
No. 50	No. 100	5-35
No. 100	No. 200	2-10
No. 200	-	0- 7

The manufacture and use of stone sand for bituminous concrete has several features which are simple but effective in assuring a fine aggregate of proper and uniform gradation in the bituminous mix.

In the manufacture of the stone sand, all of the material passes a No. 6 sieve (0.132 in. opening), which is the sieve used by the state for making the separation of coarse and fine aggregate. This small top size produces a stone sand that is free from the troublesome segregation experienced when screenings of ⅜ in. maximum size are used, for the particles with the relatively large mass have been removed. The wet process of manufacture is used so the amount of minus 200 mesh material is reduced and carefully controlled. This also materially reduces the amount of segregation caused by the very fine particles. For example, a stockpile of screenings that has been built into a cone will have the coarse particles on the outside and the fine particles in the center. Whereas, in the manufactured sand the amounts of very coarse and very fine particles have been reduced to the point that they are not present in amounts to cause segregation.

Another factor contributing toward the elimination of segregation is most important. The uninitiated look upon it as a necessary evil, while the experienced producer appreciates its value. This factor is moisture. In processing, the stone sand is passed through a drag box, or classifier, for controlling the minus 200 mesh material, and it is then stockpiled for dewatering. Actually, this stockpiling accomplishes more than just the removal of water, for the material is allowed to remain in stockpile until the moisture content has been reduced to 4 or 5 per cent. With a moisture content of 4 to 5 per cent, there is no flow of water downward in the stockpile. The fine particles adhere to the coarser particles so that when a shovel digs into a pile of the stone sand and there is some caving in, the appearance of the entire pile is one of uniform gradation. Likewise, this material can be hauled, stockpiled at the asphalt plant, loaded into bins, and fed onto the cold feed elevator without segregation.

The engineers of the Ohio Highway Department have made a significant contribution toward the development of stone sand in their endeavor to obtain bituminous concrete of uniform grading. Control of gradation in bituminous concrete has been sought by most engineers through the application of the job mix formula. However, the practice in Ohio is to approve, for gradation, stockpiles of both coarse and fine aggregate. Once the aggregate is approved, the stone producer is relieved of responsibility as to grading. The state engineers establish the job mix formula from samples of materials the contractor proposes to use. The control of the composition of the bituminous mix is as follows: "Any variation from the job mix formula as shown by the plant inspector's analysis showing a variation of more than ±3 per cent of total retained on No. 6 sieve or ±0.3 per cent 'bitumen' shall be investigated and the contractor required to correct the condition causing such variation. Any variation as found above exceeding ±5 per cent 'Total Retained on No. 6 sieve', or ±0.5 per cent 'bitumen', or a grading outside of the composition limits as shown in the respective composition tables shall be sufficient cause for the laboratory to discontinue production until the cause of the variation has been corrected."

After the aggregate has been passed through the dryer, the only screen used to size the fine aggregate is the No. 6. The engineers, therefore, use this screen to control the fines in their bituminous mix. They do not believe in setting up requirements on the No. 20, No. 40, No. 80, and No. 200 mesh sieves in the job

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Maintenance and Its Tie-In With Safety[1]

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WITH the short time at my disposal, I can but touch on only a few highlights of this important subject. Since I have spent the greater part of my life working with or supervising maintenance crews, I feel I am qualified to speak on the subject with some modicum of authority. While this paper is written from an operating man's viewpoint, you men present who deal only with the intangible, safety, will also understand that my discourse is predicated on the fact that maintenance, safety and production are a so closely knit trio that without one the other two suffer.

I feel that a good safety-minded maintenance crew is one of the best tools a safety director has at his disposal. I say this with due regard to all the gadgets, personal dress programs, and other devices that we use constantly to keep our plants accident free. I would like to give you my definition of accident prevention; namely, "Stopping an accident before it happens." Where can you find a better tool to do this with than your maintenance crew? In a lot of plants the maintenance and safety departments are considered as stepchildren, as neither is considered by them to be a production service. Yet, in such plants where management is so shortsighted, we find loss of production through breakdowns and excessive insurance premiums due to accidents. In plants of this nature it is imperative that the two departments work together for the common cause of safety.

A good maintenance crew can point out potential hazards as they come up in the course of normal repairs. Loose or worn parts that might fly off or apart will not only be reported but will be taken care of. Then, too, a good crew makes sure their work is done well so nuts, etc., are tightened properly and thus will not jiggle loose and become a hazard. A safety-minded crew will never leave a job as finished unless all guards are replaced and in good shape. Often times they will redesign guards, rails, and ladders to make them more efficient or practical. This is especially true in your smaller plants, where no engineering department is available.

The craftsmen normally found in a maintenance crew are usually "gadgeteers." By this I mean in their spare time they are making gadgets that will make their work easier and lighter. For instance, the machinist will make jigs and fixtures that will in turn make his spare parts as near alike each time as is humanly possible with the equipment on hand. The welder will also make certain clamps, fixtures, etc., that will make his work easier and so on through the list of trades. Encourage this, because, as the worker makes his work simpler, he makes it safer. This is a fact that many people have never realized. Consider this, however, and you will see the whyfor. The less a person has to do or think about when performing a piece of work, the fewer physical hazards he exposes himself to and the freer his mind is to concentrate well on the small task at hand.

We promote safety every time we simplify a job, equipment, or method. The steam generator of today versus the old hand fired coal boiler is a practical example of what I am talking about. Today a fireman has but a few switches to throw and pressure and water are automatically taken care of, whereas the old boiler took backbreaking shoveling, constant watchfulness of water, damper and pressure gauge, to say nothing of slice bars and hoes for the ash pit and a wheelbarrow to haul out the ashes. A good crew will also find that by modifying existing wheel and bearing pullers and other tools, the work of tearing down or reassembling can be made easier and safer. A word of praise from the master mechanic, superintendent, and especially the man in charge of safety will usually spur these men on to still further improve these maintenance tools.

I can cite an instance in my own plant where this is the case; namely, removing the eccentric from one of our crushers. Formerly, the eccentric and bottom plate were dropped, using hydraulic jacks and wood blocking with the usual long threaded rods for holding. Today with two simple welded clevises and two Coffing hoists, the mechanism is dropped in

[1] Presented before the Cement and Quarry Section, 40th National Safety Congress, Chicago, Ill., October 21, 1952

one-third the time and with the safety factor increased a hundred fold. This particular method has undergone at least three different changes until we arrived at the procedure we now use.

I would also like to urge management to provide lifting mechanisms wherever heavy objects or pieces of equipment have to be moved from time to time. There are several cheap light modifications of the original Coffing hoist on the market today. These hoists cost far less than a minor back case. I would particularly recommend the purchase of hoists for handling well drill bits, heavy machine elements in and out of lathes, truck parts in the garage, spare parts in the storeroom, even your shovel in the quarry should have one. These hoists will eliminate the terrific hazard that exists where men have to move heavy, bulky objects by brute force.

Today in my plant we have a "tool" that is indispensable and we often times wonder how we ever got along without it years ago. I am referring to a home-made hoist truck. We mounted a single drum hoist on an old obsolete truck and built derrick legs on the rear of the platform. The bottom of the center brace of the derrick is movable so the derrick can be raised or lowered according to the demand of the job. The front bumper is weighted and a provision is made in the mast head to secure a sheave block whereby the capacity of the rig may be increased. This piece of equipment has been used for everything from bailing out well drill holes for a shot to setting a crusher in place. It is patterned after the portable rigs power and telephone companies use to place poles. I feel this maintenance tool—and you will find many other uses for it, too—will save a good many contusions, smashed extremities, and back injuries in any plant that has one.

A good preventive maintenance program is possibly the best means of insuring uninterrupted production. That this program is definitely tied in with safety can better be understood when one realizes a large insurance carrier now does not use safety engineers any more as inspectors but sends out mechanical engineers to help increase production and help solve maintenance problems in its clients' plants.

The plant I operate has an alert maintenance crew. I can name several safety measures promulgated by them. They were the first among our employees to wear safety shoes and goggles in our operations. They have installed on their own initiative guards and railings that were not requested by either Labor Department or insurance carrier inspectors. When repairs are made on equipment, invariably something is noticed and either is taken care of on the spot or at least reported. Often times suggestions are made concerning safer methods of repair or guarding. Our plant is not unique in having such a crew as I know several other local quarry operations have similar ones. Sell your maintenance crew safety and they will sell it to the rest of your employees.

I am not going to talk about electrical maintenance as that has been well covered in another paper. I merely wish to mention in passing that electrical repairs should be made only by a competent electrician or at least under his close supervision. One fatality already has been reported this year to the Accident Prevention Committee of the National Crushed Stone Association because an employee hooked up a portable pushbutton switch on a crusher feeder incorrectly.

A maintenance tool that has recently come to the front will also provide a good measure of safety that quarrymen have not enjoyed heretofore. I am referring to the reflectoscope which can detect flaws, cracked shafts, etc., without disassembling the equipment. It is even better than a visual examination as most times the start of a crack is invisible to the naked eye. One of these machines has been in use by a large eastern operator for over two years and in that time his men have found cracks in well drill stems, a crusher shaft, and a screen shaft. In the case of the crusher shaft, they did not believe the machine, yet this shaft broke within a month after inspection exactly at the point the machine indicated the crack to be. Just think of the potential safety and production insurance this piece of equipment can offer. I believe that any operator who utilizes this machine will not only insure himself of continued operation but will make his plant that much safer. While the machine is expensive at present, in fact too expensive for many operators, the manufacturer of the machine does have a rental service that can be taken advantage of by nearly all.

In conclusion I would like to point out one more subject that too often is neglected or thought little about as part of the safety programs; namely, the upkeep of quarry haulage units. Too many operators neglect to keep these units in A-number-one shape physically. Their road equipment used for delivery, etc., are usually maintained well, not only from the angles of prompt service and safety on the highway but for advertising as well. Whereas the quarry hauling units are comparatively slow, hardly

anyone sees them except the employees and traffic conditions are negligible. For these reasons many operators do not spend time and money on these units except to keep them running. Brakes, lights, rear view mirrors, windshield wipers, etc., are just as important on this equipment as they are on over the road delivery trucks. Along this same line of thought is the maintenance of the haul road. Spillage and holes in the road are two bad offenders. Hardly a month goes by that a lost time accident is not reported to the National Crushed Stone Association either from mechanical failure of haulage units or poor road conditions. I firmly believe this is a subject that every operator should study and take every step possible to insure accident free operation of his haulage equipment on his own property. The maintenance of the haul road is important from all three standpoints: production, safety, and maintenance of equipment. A poor haul road soon gives trouble to the power units in springs, tires, drive mechanisms, and trailer hitches if that type of equipment is used. It takes a lot more out of the drivers as well and certainly the speed must be reduced when traveling over bumpy, uneven roads full of stones and holes that get worse daily. This condition is found in a good many quarries and it seems to me that it is another case of the Shoemaker's wife going barefoot as the old man won't make her a pair. Keep your haul roads like super highways and your quarry haul units like you do your car and see your production increase, your maintenance costs go down and your safety record go up, to say nothing of happier employees. All this in turn of course makes both the boss and the stockholders happy, too.

Some Straws in the Wind

(Continued from Page 14)

Highway Departments, the Federal Government and other sources. From the time we began these courses there has been very great interest and our students have returned again and again. Evidently they feel them to be worth while, probably because they are eager to hear discussed certain technical details dealing with the uses of stone and which, for lack of time, are not included in the programs of our Annual Convention.

Well, there are many more problems which could be mentioned, perhaps hundreds of them, dealing with the every day uses of crushed stone. We are set up to help you individually on these problems. Our laboratory is continuously engaged in getting the facts and, as I have told you many times before, we are always glad to be of assistance to all of our members, those having either large or small production, that does not matter.

Current Practices in Use of Quarry Fines in Bituminous Concrete

(Continued from Page 19)

mix formula when these requirements cannot be enforced. The bituminous mix must be within the limits of the specifications. This is accomplished by designing the mix based on tests of the materials as sampled from stockpile. Since the specifications for T 50, type B, medium textured bituminous concrete of ½ in. maximum size require 45 to 55 per cent coarse aggregate, the job mix formula does not set up a grading band within the specification.

Indications

The indications from the practices as herein reviewed are that:

1. Due to variations in gradation, in quarry run screenings are sometimes not a satisfactory aggregate for bituminous concrete.
2. Screenings resulting from secondary crushing may be used by blending with natural sand for the fine aggregate and using as much and as large a maximum size of coarse aggregate as will reduce the variation in gradation of the screenings to within allowable limits.
3. Manufactured stone sand has been found to be an acceptable fine aggregate for bituminous concrete primarily because the gradation has been suitable and reasonably uniform.

Conclusion

It must therefore be concluded that for crushed stone screenings to be a satisfactory fine aggregate for bituminous concrete some method or procedure should be used which will assure a satisfactory gradation having reasonable uniformity.

New York Convention Draws Over 800

(Continued from Page 9)

Crushed Stone Association Safety Contest. For the first time in our recollection, each of the ten plants winning recognition in the contest had representatives present in person to receive the awards which were presented by C. A. Gustafson, Chairman of the NCSA Accident Prevention Committee. In the accompanying photograph the representatives of each of the winning plants are shown.

A meeting of the Accident Prevention Committee was held at dinner on Tuesday evening, February 3, during which there was a thorough discussion of ways and means to improve the Monthly Accident Review. It was the concensus of the meeting that the Review was proving of great help in its effort to reduce accidents and Mr. Gustafson, Editor of the Review, was highly complimented for his outstanding contribution toward its success.

Carroll S. Huntington

HIS many friends throughout the crushed stone industry will be saddened to learn of the death of C. S. Huntington who, before his retirement several years ago, was Chief Engineer of the Pershing Road Plant of the Link-Belt Company in Chicago. Following a long illness, death was due to a heart attack on December 24, 1952.

Mr. Huntington was actively identified with the National Crushed Stone Association through its Manufacturers Division. He was first elected to the Manufacturers Division Board of Directors in 1930 and served continuously through 1948. He served as Vice Chairman of the Division from 1931 through 1935, and became Chairman in 1936. As a representative of the Division, Mr. Huntington served on the NCSA Board of Directors in 1936 and 1937.

During his active participation in the affairs of the Manufacturers Division, Mr. Huntington made a real and constructive contribution towards its development and growth.

Our sincere sympathy is extended to his family and business associates.

Thomas H. MacDonald to Retire As Commissioner of Public Roads

(Continued from Page 15)

During the War the Bureau enlisted the aid of state highway departments in the rapid construction of highways to serve defense establishments of various kinds. At the same time it undertook one of the world's best known highway projects, construction of the Alaska Highway. Mr. MacDonald personally directed the major steps in accomplishing this work.

The work under Mr. MacDonald's direction was not limited to the United States. For a number of years the Bureau has supervised the expenditure of funds authorized to aid the countries of Central America in building the Inter-American Highway. Under various legislative authorizations it has furnished staffs of engineers to aid the governments of the Philippines, Turkey, Ethiopia, Bolivia, Liberia, and other countries in building modern highways.

He has been a prolific writer on all phases of highway improvement. In recent years his papers have been directed toward the widespread highway deficiencies and the urgency of their correction.

Mr. MacDonald has received numerous honorary awards during his career, including the honorary degree Doctor of Engineering and the Marston Medal for achievement in engineering by Iowa State College; and the Medal of Merit for outstanding service during World War II. He has represented the United States and headed delegations at numerous foreign conferences and gatherings. He is honorary member of the American Society of Civil Engineers and the Institute of Traffic Engineers; member of the Executive Committee of American Association of State Highway Officials; Executive Committee, Highway Research Board; Chairman, Committee on Program and Planning of the President's Highway Safety Conference; member of the National Safety Council, and the American Planning and Civic Association.

While retiring from government service after a distinguished career, we understand Mr. MacDonald is to continue his activities in the highway field. Shortly after April 1, 1953, he goes to Texas A&M College to act as consultant in the development of a Transport Institute at that college. Our every good wish goes with Mr. MacDonald in this new undertaking.

Manufacturers Division — National Crushed Stone Association

These associate members are morally and financially aiding the Association in its efforts to protect and advance the interests of the crushed stone industry. Please give them favorable consideration whenever possible.

Allis-Chalmers Mfg. Co.
Milwaukee 1, Wis.
Crushing, Screening, Washing, Grinding, Cement Machinery; Motors; Texrope Drives; Centrifugal Pumps; Tractors

American Cyanamid Co.
Explosives Department
30 Rockefeller Plaza, New York 20, N. Y.
Explosives and Blasting Supplies

American Manganese Steel Division
American Brake Shoe Co.
109 North Wabash Ave., Chicago 2, Ill.
Manganese Steel Castings, Power Shovel Dippers, Material Handling Pumps, Heat and Corrosion Resistant Castings, Reclamation and Hard-Facing Welding Materials

American Pulverizer Co.
1249 Macklind Ave., St. Louis 10, Mo.
Manufacturers of Ring Crushers and Hammermills for Primary and Secondary Crushing

American Steel & Wire Division
Rockefeller Bldg., 614 Superior Ave., N. W., Cleveland 13, Ohio
Wire Rope, Aerial Wire Rope Tramways, Electrical Wires and Cables, Welded Wire Fabric, Concrete Reinforcing, Wire Nails, Fencing, Netting

Atlas Powder Co.
Wilmington 99, Del.
Industrial Explosives and Blasting Supplies

Bacon-Greene & Milroy
205 Church St., New Haven 10, Conn.
"FARREL-BACON" Jaw Crushers for Primary and Secondary Operations, Conveyors, Elevators, Rolls, Screens

Bacon-Pietsch Co., Inc.
75 North Maple Ave., Ridgewood, N. J.
Manufacturers of Farrel-Bacon Crushers and Allied Screening and Conveying Equipment

Baldwin-Lima-Hamilton Corp.
Construction Equipment Division
South Main St., Lima, Ohio
Power Shovels, Draglines, Cranes, Bins, Conveyors and Idlers, Crushers and Pulverizers, Feeders, Plants—Crushing and Portable, Washing Equipment

Barber-Greene Co.
631 West Park Ave., Aurora, Ill.
Portable and Permanent Belt Conveyors, Belt Conveyor Idlers, Bucket Loaders both Wheel and Crawler Mounted, Asphalt Mixers and Finishers, Coal Handling Machines

Buchanan, C. G., Crushing Machinery Division, Birdsboro Steel Foundry and Machine Co.
1941 Furnace St., Birdsboro, Pa.
Primary, Secondary, and Finishing Crushers and Rolls

Bucyrus-Erie Co.
South Milwaukee, Wis.
Excavating, Drilling and Material Handling Equipment

Buda Co.
154th St. and Commercial Ave., Harvey, Ill.
Diesel and Gasoline Engines; Material Handling Equipment; Lifting Jacks; Earth Drills and Maintenance of Way Equipment

Caterpillar Tractor Co.
Peoria 8, Ill.
Track-Type Tractors, Bulldozers, Earthmoving Scrapers, Motor Graders, Heavy-Duty Off-Road Hauling Units, Diesel Engines, and Diesel Electric Generating Sets

Chain Belt Co.
P. O. Box 2022, Milwaukee 1, Wis.
Rex Conveyors, Elevators, Feeders, Idlers; Drive and Conveyor Chains, Power Transmission Equipment; Concrete Mixers, Pavers, Pumpcrete and Portable Pumps

Construction Equipment
205 East 42nd St., New York 17, N. Y.
"The Equipment Application Magazine"

Continental Gin Co.
4500 Fifth Ave., S., Birmingham 2, Ala.
Conveyors—Belt, Screw, Flight, and Underground Mine; Elevators—Bucket and Screw; Feeders—Apron, Belt, Reciprocating, Table, and Screw; Drives—V-Belts, Chains and Sprockets, Gears and Speed Reducers

Cross Engineering Co.
P. O. Box 16, Carbondale, Pa.
Screen Plates and Sections, Perforated Plate for Vibrating, Rotary and Shaking Screens

Cummins Engine Co., Inc.
Fifth and Union Sts., Columbus, Ind.
Lightweight Highspeed Diesel Engines (50-550 Hp.) for: On-Highway Trucks, Off-Highway Trucks, Buses, Tractors, Earthmovers, Shovels, Cranes, Industrial and Switcher Locomotives, Air Compressors, Logging Yarders and Loaders, Oil Well Drilling Rigs, Centrifugal Pumps, Generator Sets and Power Units, Work Boats and Pleasure Craft

Manufacturers Division—National Crushed Stone Association
(continued)

Deister Machine Co.
1933 East Wayne St., Fort Wayne 4, Ind.
Deister Plat-O Vibrating Screen, Deister Compound Funnel Classifier

Detroit Diesel Engine Division General Motors Corp.
13400 West Outer Drive, Detroit 28, Mich.
Light Weight, Compact 2 Cycle Diesel Engines and "Package Power" Units for All Classes of Service

Diamond Iron Works, Inc.
1728 North Second St., Minneapolis 11, Minn.
Jaw and Roll Crushers; Vibrator, Revolving, and Scrubber Screens; Drag Washers; Bucket Elevators; Belt Conveyors; Bins; Apron and Plate Feeders; Portable Gravel and Rock Crushing, Screening, and Washing Plants; Stationary Crushing, Screening, and Washing Plants; Hammermills

Du Pont, E. I., de Nemours & Co., Inc.
Wilmington 98, Del.
Explosives and Blasting Accessories

Eagle Iron Works
129 Holcomb Ave., Des Moines 13, Iowa
Fine Material Screw Washers—Classifiers—Dehydrators; Coarse Material Screw and Log Washers—Dewaterers; Water Scalping and Fine Material Settling Tanks; and "Swintek" Screen Chain Cutter Dredging Ladders

Easton Car & Construction Co.
Easton, Pa.
Off-Highway Transportation: Dump Trailers, Truck Bodies, and Cars for Mines, Quarries, and Earth Moving Projects

Ensign-Bickford Co.
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Primacord-Bickford Detonating Fuse and Safety Fuse

Euclid Road Machinery Co.
1361 Chardon Road, Cleveland 17, Ohio
Heavy-Duty Trucks and Dump Trailers for "Off-Highway" Hauls, Loaders for Earth Excavation

Even Spread Co.
P. O. Box 98, Owensville, Ohio
Power Spreaders and Attachments for Agricultural Lime and Fertilizer

Frog, Switch & Mfg. Co.
Carlisle, Pa.
Manganese Steel Department—Manufacturers of "Indian Brand" Manganese Steel Castings for Frogs, Switches, and Crossings, Jaw and Gyratory Crushers, Cement Mills, Mining Machinery, Etc., Steam Shovel Parts

General Electric Co.
1 River Road, Schenectady 5, N. Y.
Electric Motors, Controls, Locomotives, Coordinated Electric Drives for: Shovels, Drag Lines, Conveyors, Hoists, Cranes, Crushers, Screens, Etc.; Coordinated Power Generating and Distributing Systems Including Turbine Generators, Switchgear, Transformers, Cable, Cable Skids, Load Center Substations

Gill Rock Drill Co.
Lebanon, Pa.
Well Drill Tools and Supplies

Goodrich, B. F., Co.
500 South Main St., Akron 18, Ohio
Industrial Rubber Products — Flexible Bonded Edge Conveyor and Elevator Belting, Cord Conveyor Belting, Highflex and Cord Transmission Belting; Grommet V-Belts; Type 54 Air Hydraulic Control, Burst Proof Steam, Water, Suction and Other Hose; Armorite Chute Lining; Rubber and Koroseal Protective Clothing and Footwear; Tires and Tubes (Automobile, Truck, Off-the-Road, Industrial), Batteries

Goodyear Tire & Rubber Co., Inc.
Akron 16, Ohio
Airfoam; Mechanical Goods—Belting (Conveyor, Elevator, Transmission), Hose (Air, Water, Steam, Suction, Miscellaneous), Chute Lining (Rubber); Rims (Truck and Tractor); Storage Batteries (Automobile, Truck, Tractor); Tires (Automobile, Truck, Off-the-Road); Tubes (Automobile, Truck, Off-the-Road, LifeGuard, Safety Tubes, Puncture Seal Tubes)

Gruendler Crusher and Pulverizer Co.
2915 North Market St., St. Louis 6, Mo.
Rock and Gravel Crushing and Screening Plants, Jaw Crushers, Roll Crushers, Hammermills, Lime Pulverizers

Gulf Oil Corp. Gulf Refining Co.
Gulf Bldg., Pittsburgh 19, Pa.
Lubricating Oils, Greases, Gasoline and Diesel Fuels

Haiss, George, Mfg. Co., Inc., Division of Pettibone Mulliken Corp.
5720 Empire State Bldg., New York 1, N. Y.
Bucket Loaders, Buckets, Portable and Stationary Conveyors, Car Unloaders

Harnischfeger Corp.
4400 West National Ave., Milwaukee 14, Wis.
A complete line of Power Excavating Equipment, Overhead Cranes, Hoists, Smootharc Welders, Welding Rod, Motors and Generators, Diesel Engines

HarriSteel Products Co.
420 Lexington Ave., New York 17, N. Y.
Woven Wire Screen Cloth

Manufacturers Division—National Crushed Stone Association
(continued)

Hayward Co.
50 Church St., New York 7, N. Y.
Orange Peel Buckets, Clam Shell Buckets, Electric Motor Buckets, Automatic Take-up Reels

Heidenreich, E. Lee, Jr.
Consulting Engineers
75 Second St., Newburgh, N. Y.
Plant Layout, Design, Supervision; Open Pit Quarry Surveys; Appraisals—Plant and Property

Hendrick Mfg. Co.
Carbondale, Pa.
Perforated Metal Screens, Perforated Plates for Vibrating, Shaking, and Revolving Screens; Elevator Buckets; Test Screens; Wedge Slot Screens; Open Steel Floor Grating

Hercules Powder Co.
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Hetherington & Berner Inc.
701-745 Kentucky Ave., Indianapolis 7, Ind.
Asphalt Paving Machinery, Sand and Stone Dryers, Dust Collectors

Hewitt-Robins Incorporated
666 Glenbrook Road, Stamford, Conn.
Belt Conveyors (Belting and Machinery); Belt and Bucket Elevators; Car Shake-outs; Feeders; Industrial Hose; Screen Cloth; Sectional Conveyors; Skip Hoists; Stackers; Transmission Belting; Vibrating Conveyors, Feeders, and Screens; Design and Construction of Complete Plants

Illinois Powder Mfg. Co.
506 Olive St., St. Louis 1, Mo.
Gold Medal Explosives

Ilyus, Brown & Associates
120 Day Ave., S.W., Roanoke 16, Va.
Consulting Engineering in Rock, Coal and Ore Preparation Plants, Materials Handling, Surveys, Appraisals, and Analysis

Ingersoll-Rand Co.
11 Broadway, New York 4, N. Y.
Rock Drills, Quarrymaster Drills, Jackbits, Bit Reconditioning Equipment, Portable and Stationary Air Compressors, Air Hoists, Slusher Hoists, Air Tools, Diesel Engines, Pumps

Insley Manufacturing Corp.
801 North Olney St., Indianapolis 6, Ind.
Concrete Carts and Buckets, ½ Yd. Cranes and Shovels

International Harvester Co.
180 North Michigan Ave., Chicago 1, Ill.
Motor Trucks, Diesel and Gasoline Power Units; Crawler Tractors; Industrial Wheel Tractors

Iowa Manufacturing Co.
916 16th St., N.E., Cedar Rapids, Iowa
Rock and Gravel Crushing, Screening, Conveying and Washing Plants, Hot and Cold Mix Asphalt Plants, Stabilizer Plants, KU-BIT Impact Breakers, Screens, Elevators, Conveyors, Portable and Stationary Equipment, Hammermills, Bins

Jaeger Machine Co.
550 West Spring St., Columbus 16, Ohio
Portable and Stationary Air Compressors, Self-Priming Pumps, Truck Mixers, Concrete Mixers, Road Paving Machinery, Hoists and Towers

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Multiwall Paper Bags, Sewn and Pasted Style for Packaging Lime, Cement, Plaster, Etc.

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East First Ave., Columbus 16, Ohio
Material Handling Machinery, Crushers, Pulverizers, Screens, Chains

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Joy Manufacturing Co.
333 Henry W. Oliver Bldg., Pittsburgh 22, Pa.
Drills: Blast-Hole, Wagon, Rock, and Core; Air Compressors: Portable, Stationary, and Semi-Portable; Aftercoolers; Portable Blowers; Carpullers; Hoists; Multi-Purpose and Portable Rock Loaders; Air Motors; Trench Diggers; Belt Conveyors; Drill-Bit Furnaces; "Spaders"; "String-a-Lite" (Safety-Lighting-Cable); Backfill Tampers; Drill Bits: Rock and Core

Kennedy-Van Saun Mfg. & Eng. Corp.
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Kensington Steel Co.
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Manganese Steel Castings, Dipper Teeth, Crawler Treads, Jaw Plates, Concaves and Hammers

King Powder Co., Inc.
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Detonite, Dynamites, and Blasting Supplies

Koehring Co.
3026 West Concordia Ave., Milwaukee 16, Wis.
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Heavy Duty Multiwall Paper Bags

Manufacturers Division—National Crushed Stone Association
(continued)

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Air Compressors—Portable 60 Cfm. to 600 Cfm. Gas or Diesel; Tractairs—Combined Tractor with 105 Cfm. Air Compressor; Engines; Generator Sets; Rock and Wagon Drills; Jumbo Drill Rigs, Drifters, Stopers, Self Propelled Drill Rigs

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Complete Stone Preparation Plants; Conveyors, Elevators, Screens, Washing Equipment, Speed-O-Matic Shovels—Cranes—Draglines and Power Transmission Equipment

Ludlow-Saylor Wire Co.
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Woven Wire Screens and Wire Cloth of Super-Loy, All Commercial Alloys and Metals

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350 Fifth Ave., New York 1, N. Y.
On- and Off-Highway Trucks, Tractor Trailers, Six-Wheelers, from 5 to 30 Tons Capacity, both Gasoline- and Diesel-Powered

Marion Power Shovel Co.
617 West Center St., Marion, Ohio
A Complete Line of Power Shovels, Draglines, and Cranes

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Complete Pit, Mine, and Quarry Equipment —Crushers, Washers, Screens, Feeders, etc.

Michigan Power Shovel Co.
270 Miller St., Benton Harbor, Mich.
Truck Mounted and Crawler Shovel Crane 3/8 and 1/2 Cu. Yd.

Murphy Diesel Co.
5317 West Burnham St., Milwaukee 14, Wis.
Murphy Diesel Engines Ranging from 90 to 190 Continuous Horsepower at 1200 Rpm. and Packaged Type Generator Sets 60 to 133 Kw. for All Classes of Service

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100 Park Ave., New York 17, N. Y.
Conveyor Belting: Stonore, Dependable, and Cameo Grades; Transmission Belting: Silver Duck Duroflex, Soft Duck Rugged, Commercial Grade Tractor

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Cone, Gyratory, Jaw and Impact Crushers; Grinding Mills; Stone Plant and Cement Mill Machinery; Vibrating Screens; Grizzlies; Diesel and Steam Engines; Compressors; Mine Hoists; Track Maintenance Tools

Northern Blower Co.
6409 Barberton Ave., Cleveland 2, Ohio
Dust Collecting Systems, Fans—Exhaust and Blower

Northwest Engineering Co.
135 South LaSalle St., Chicago 3, Ill.
Shovels, Cranes, Draglines, Pullshovels

Olin Industries, Inc.
Explosives Division
East Alton, Ill.
Dynamite, Black Powder, Blasting Caps, Blasting Supplies

Osgood Co.
Cheney Ave., Marion, Ohio
Power Shovels, Cranes, Draglines, Hoes, Etc., 3/8 to 2 1/2 Cu. Yd.

Pennsylvania Crusher Co.
Liberty Trust Bldg., Broad and Arch Sts., Philadelphia 7, Pa.
Single Roll Crushers, Impactors, Hammermills, Ring Type Granulators, KUE-KEN Jaw Crushers, KUE-KEN Gyracones, Dixie Non-Clog and Standard Hammermills

Pettibone Mulliken Corp.
4710 West Division St., Chicago 51, Ill.
Buckets, Dragline and Parts; Loaders—Car, Bucket; Plants—Asphalt, Portable

Pioneer Engineering Works, Inc.
1515 Central Ave., N. E., Minneapolis 13, Minn.
Jaw Crushers, Roll Crushers (Twin and Triple), Vibrating and Revolving Screens, Feeders (Mechanical, Grizzly, Apron, and Pioneer-Oro), Belt Conveyors, Portable and Stationary Crushing and Screening Plants, Washing Plants, Mining Equipment, Cement and Lime Equipment, Asphalt Plants

Pit and Quarry Publications
431 South Dearborn St., Chicago 5, Ill.
Pit and Quarry, Pit and Quarry Handbook, Pit and Quarry Directory, Concrete Manufacturer, Concrete Industries Yearbook

Quaker Rubber Corp.
Tacony and Milnor Sts., Philadelphia 24, Pa.
Conveyor Belts, Hose, and Packings

Rock Bit Sales and Service Co.
350 Depot St., Asheville, N. C.
Tungsten Carbide Detachable Bits, "Rock Bit" Drill Steel inlaid with Tungsten Carbide, Carbon Hollow Drill Steel, Alloy Hollow Drill Steel

Rock Products
309 West Jackson Blvd., Chicago 6, Ill.

Manufacturers Division—National Crushed Stone Association
(concluded)

Rogers Iron Works Co.
11th and Pearl Sts., Joplin, Mo.
Jaw Crushers, Roll Crushers, Hammermills, Vibrating Screens, Revolving Screens and Scrubbers, Apron Feeders, Reciprocating Feeders, Roll Grizzlys, Conveyors, Elevators, Portable and Stationary Crushing and Screening Plants, Mine Hoists, Drill Jumbos and Underground Loaders

Screen Equipment Co., Inc.
1754 Walden Ave., Buffalo 25, N. Y.
SECO Vibrating Screens

Simplicity Engineering Co.
Durand, Mich.
Simplicity Gyrating Screen, Simplicity D'centegrator, Simplicity D'watering Wheel

SKF Industries, Inc.
Front St. and Erie Ave., P. O. Box 6731,
Philadelphia 32, Pa.
Anti-Friction Bearings—Self-Aligning Ball, Single Row Deep Groove Ball, Angular Contact Ball, Double Row Deep Groove Ball, Spherical Roller, Cylindrical Roller, Ball Thrust, Spherical Roller Thrust; Pillow Block and Flanged Housings—Ball and Roller

Smith Engineering Works
532 East Capitol Drive, Milwaukee 12, Wis.
Gyratory, Gyrasphere, Jaw and Roll Crushers, Vibrating and Rotary Screens, Gravel Washing and Sand Settling Equipment, Elevators and Conveyors, Feeders, Bin Gates, and Portable Crushing and Screening Plants

Stedman Foundry & Machine Co., Inc.
Aurora, Ind.
Stedman Impact-Type Selective Reduction Crushers, 2-Stage Swing Hammer Limestone Pulverizers

Stephens-Adamson Mfg. Co.
Aurora, Ill.
Belt Conveyors, Elevators, Feeders, Car Pullers, Screens, Skip Hoists, Complete Plants

Talcott, W. O. & M. W., Inc.
91 Sabin St., Providence 1, R. I.
Belt Fasteners, Belt Lacing, Conveyor Belt Fasteners, and Patch Fasteners

Taylor-Wharton Iron & Steel Co.
High Bridge, N. J.
Manganese and other Special Alloy Steel Castings; Dipper Teeth, Fronts and Lips; Crawler Treads; Jaw and Cheek Plates; Mantles and Concaves; Pulverizer Hammers and Liners; Asphalt Mixer Liners and Tips; Manganese Nickel Steel Welding Rod and Plate

Thew Shovel Co.
East 28th St. and Fulton Rd., Lorain, Ohio
Power Shovels, Cranes, Crawler Cranes, Locomotive Cranes, Draglines, Diesel Electric, Gasoline, 3/8 to 2 1/2 Cu. Yd. Capacities

Torrington Co.
Bantam Bearings Division
3702 West Sample St., South Bend 21, Ind.
Anti-Friction Bearings; Roller Bearings: Spherical, Tapered, Straight, Ball, Needle

Traylor Engineering & Mfg. Co.
Allentown, Pa.
Stone Crushing, Gravel, Lime, and Cement Machinery

Trojan Powder Co.
17 North 7th St., Allentown, Pa.
Explosives and Blasting Supplies

Tyler, W. S., Co.
3615 Superior Ave., N. E., Cleveland 14, Ohio
Woven Wire Screens; Ty-Rock, Tyler-Niagara and Ty-Rocket (Mechanically Vibrated) Screens; Hum-mer Electric Screens; Ro-Tap Testing Sieve Shakers and Tyler Standard Screen Scale Sieves

Universal Engineering Corp.
625 C Ave., N. W., Cedar Rapids, Iowa.
Jaw Crushers, Roll Crushers, Hammermills, Complete Crushing, Screening, and Loading Plants, Either Stationary or Portable for Stone Aggregates or Aglime, Portable and Stationary Washing Plants, Asphalt Plants, and Impact Breakers

Vibration Measurement Engineers
7665 Sheridan Road, Chicago 26, Ill.
Specialists in Blasting Complaint Investigations; Seismological Surveying; Expert Testimony in Blasting Litigation

Werco Steel Co.
2151 East 83rd St., Chicago 17, Ill.
Crusher Jaws, Roll Shells, Mantles, Bowl Liners, Conveyor and Elevator Chain, All Types Wear Resistant Steel Manganese and Alloy Steel Castings, Screen Plate—Perforated Steel, Screen Sections and Decks

Weston Dump Body Co.
326 S.W. 11th St., Des Moines 9, Iowa
Combination Lime, Sand, and Gravel Body; Special Bodies for Quarry and Pit Work

White Motor Co.
842 East 79th St., Cleveland 1, Ohio
On- and Off-Highway Trucks and Tractors—Gasoline- and Diesel-Powered; Industrial Engines, Power Units, Axles, Special Machine Assemblies; All Classes of Service

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No. 3. Uses for Stone Screenings

No. 4. How to Determine the Required Thickness of the Non-Rigid Type of Pavement for Highways and Airport Runways

No. 5. The Insulation Base Course Under Portland Cement Concrete Pavements

ENGINEERING BULLETINS

No. 1. The Bulking of Sand and Its Effect on Concrete

No. 2. Low Cost Improvement of Earth Roads with Crushed Stone

No. 3. The Water-Ratio Specification for Concrete and Its Limitations (Supply Exhausted)

No. 4. "Retreading" Our Highways

No. 5. Reprint of "Comparative Tests of Crushed Stone and Gravel Concrete in New Jersey" with Discussion

No. 6. The Bituminous Macadam Pavement

No. 7. Investigations in the Proportioning of Concrete for Highways

No. 8. The Effect of Transportation Methods and Costs on the Crushed Stone, Sand and Gravel, and Slag Industries (Supply Exhausted)

No. 9. Tests for the Traffic Durability of Bituminous Pavements

No. 10. Stone Sand (Supply Exhausted)

No. 11. A Method of Proportioning Concrete for Strength, Workability, and Durability. (Revised January, 1949)

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Single copies of the above publications are available upon request.

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